[0037] These and other features, aspects and advantages of the present invention will become better understood with reference to the accompanying drawings, wherein:

[0038] FIG. **1** shows sample garments which are automatically constructed according to the invention;

[0039] FIG. **2** shows manual construction of the garment: (a) the given panels, (b) positioning of each panel with 3D manipulation;

[0040] FIG. **3** shows an overview of the invention;

[0041] FIG. **4** shows a cylindrical abstraction;

[0042] FIG. **5** shows T-seam and Y-seam, (a)-(b): T-seam before and after the simulation, (c)-(d): Y-seam before and after the simulation;

[0043] FIG. **6** shows complete classfication of the seam lines, * indicating the seam lines that need to be explicitly secondary-tagged by the user;

[0044] FIG. **7** shows that lines **12**, **13**, **14**, **15** are in the FOV of line **11**, and the closest line **12** is regarded as the matching seam line pair for **11**;

[0045] FIG. **8** shows panels for the rightmost garment of FIG. **1**;

[0046] FIG. **9** shows five sample garments: (a) one-piece, (b) blouse, (c) skirt, (d) pants, (e) hooded top with the input panels, automatically created seams, and draped; and

[0047] FIG. **10** shows a garment which cannot be automatically created with the invention.

DETAILED DESCRIPTION EMBODIMENTS OF THE INVENTION

[0048] Referring to the figures, the embodiments of the invention are described in detail.

1. INTRODUCTION

[0049] These days, it is an emerging trend to shop clothes in on-line, and as a consequence, there is a huge demand for the development of virtual try-on systems. An example can be viewed at metail.com, in which the user can try the clothing on her/his own avatar. To run a virtual try-on system, an obvious but important necessary condition is that the garments for sale must exist in the system. This paper is about automatic construction of the garment from the input of the comprising panels (i.e., the sewing patterns).

[0050] For the past ten years, the authors have an experience of educating the fashion people how to use the clothing simulation software to construct various types of garments. They are fascinated to see the simulated results, but when they try constructing the garments themselves, the magic suddenly turns into frustration. For example, consider a simple garment consisting of the panels shown in FIG. **2**(*a*). Positioning the panels around the body and creating seams between them calls for hundreds of panel-dragging and view changes in the 3D window, and a small mistake can produce a surprising outcome. Even to expert users, the task is cumbersome and laborious. The computer graphics field has made remarkable progress in the accuracy and speed of physical simulation, but it has made relatively less progress in enhancing the usability.

[0051] The above inconvenience becomes a must-solve problem if such construction should be done for thousands of garments per week, which is easily the case to run a commercial virtual try-on system. The ideal scenario would be the program can automatically construct the garment without any tip from the user, which is unfortunately impossible. (In fact, it is an ill-posed problem.) From the perspective of usability, the following two principles have been identified:

[0052] Determinism: Sure-success is preferred to occasional failure, even if the method calls for some tips from the user.

[0053] Dimensional Overhead: Simple labeling is preferred to 2D or 3D manipulation. If manipulation needs to be done (to the panels), doing it in 2D is preferred to doing it in 3D.

[0054] This paper proposes a new technique based on the above two principles, which lets the computer do the construction job (panel positioning and seam creation) in a deterministic way. The technique requires the user to do some preparation for the comprising panels. But the required preparation is simple labeling or manipulation in the 2D window. The proposed method turns out to very effectively relieve the attention-intensive work in the preparation of virtual garments. Before revealing the method, we highlight that (1) the above frustration has remained largely unsolved for more than a decade, and to our knowledge, (2) this is the first practically workable solution to that problem.

2. RELATED WORK

[0055] A work that is relevant to this paper is Berthouzoz et al. [2013], which extracts panels from a PDF file and parses sewing patterns to construct the virtual garment automatically. This machine-learning based method needs to have some training data set, but instead, the method does not call for any tips from the user. It is a probabilistic model, thus success is not guaranteed. They reported the success ratio was about 68%. The success ratio can be affected when the user constructs a garment the type of which is different from the ones in the training data set.

[0056] In contrast to Berthouzoz et al. [2013], this paper proposes a deterministic method (The proposed method also contains some probabilistic ingredient. However, compared to Berthouzoz et al. [2013], the probabilistic ingredient is much less.), which does not call for the training data set, and as long as the input garments are within the inherent range of the method its success ratio is over 99%. The key idea of our method is that, if the program positions the panels at sensible locations, the spatial relationship (e.g., adjacency, distance in 2D) between lines can be a crucial key for identifying the seam line pair. Concluding that finding out the sensible location of the panels can't be done without any tip, this paper devises a systematic way for the user to provide the tip: panel tagging and packing.

[0057] Meng et al. [2010] employed a hierarchy of ellipsoids to find the optimal position of the panels around the body. For the creation of complex garments, they proposed four types of user interactions to control the panel position, namely, move, rotate, fix, and drag. Introduction of the cylinders facilitated the positioning task, but the construction was not done automatically; It required a considerable amount of 3D manipulation from the user.

[0058] Automatic garment construction is a pretty new direction of research, thus there are not many papers that focus on the specific problem this paper is trying to solve. Berthouzoz et al. [2013] excellently summarizes the previous work in general on (1) parsing diagrams [Haralick and Queeney 1982; Mena 2003], (2) sketch-based garment design [Wang et al. 2003; Turquin et al. 2004; Turquin et al. 2007; Decaudin et al. 2006; Robson et al. 2011], and (3)